DOCUMENT RESUME

ED 080 368 SE 016 622

TITLE	Elementary Environmental Education.
INSTITUTION	Nolde Forest Environmental Education Center, Reading, Pa.
PUB DATE	[73]
NOTE	91p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Curriculum Guides; *Ecology; *Elementary Grades; *Environmental Education; Fundamental Concepts; Instructional Materials; Learning Activities; Natural Resources; *Sciences

ABSTRACT

The concept that society must possess an ecological conscience which can relate to economic, social, political, and other disciplines of culture to meet the challenge of maintaining a quality environment, represents the basic philosophical rationale for these instructional materials. They are designed to give specific emphasis to the ecological implications of man's activities as generally explored in the science curricula for grades one through six. The outdoor laboratory approach is employed to encourage students to become more aware of their responsibilities as citizens in conserving and preserving man's natural resources. Six generalizations about man's relationship to his environment serve as a base around which concepts, questions, and activities are built. Three concepts are identified for each generalization at both the primary and intermediate levels, and individual concepts detail open-ended questions, discovery activities, follow-up activities, and instructional materials (Multimedia). Performance objectives, suggestions for evaluation, and a bibliography of books and field guides are also provided in this curriculum guide. (BL)

FILMED FROM BEST AVAILABLE COPY

U S DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

ED 080568

NOLDE FOREST
ENVIRONMENTAL EDUCATION CENTER

ELEMENTARY ENVIRONMENTAL EDUCATION

Louis Ritrovato
Director

R.D.# 1, Box 392
Reading, Pennsylvania 19607

Telephone: (215) 775-1411

CONTENTS

		PAGE
Foreward		1-2
Performance Objectives		2a
Flow Chart (Kindergarten - Intermediate)		3-4
PRIMARY SCIENCE		
Generalization I.	All organisms are interrelated and interdependent	5-12
Generalization II.	Solar energy runs all ecosystems. Matter within ecosystems is cyclic, while energy is dissipated and must be continually supplied.	13-18
Generalization III.	There are biological activities that are characteristic of living organisms	19-25
Generalization IV.	Life cannot be static: It must adapt and evolve or perish	26-29
Generalization V.	Biological and physical factors will define the limitations of organisms	30-37
Generalization VI.	The enormous power of man to affect whole ecosystems is of great importance to the future of the biosphere	38-41
INTERMEDIATE SCIENCE		
Generalization I.	All organisms are interrelated and interdependent	42-48
Generalization II.	Solar energy runs all ecosystems. Matter within ecosystems is cyclic, while energy is dissipated and must be continually supplied	49-56
Generalization III.	There are biological activities that are characteristic of living organisms	57-62
Generalization IV.	Life cannot be static; It must adapt and evolve or perish	63-68
Generalization V.	Biological and physical factors will define the limitations of organisms	69-74
Generalization VI.	The enormous power of man to affect whole ecosystems is of great importance to the future of the biosphere	75-80
Appendix		81-82
Key to Instructional Materials		83
Bibliography		84-87
Evaluation		88

FOREWORD

As we begin this decade of the seventies, man has become increasingly aware of the fact that to preserve the earth's natural environmental quality is, in essence, to insure his own survival as a species. Daily this fact is made blatantly clear as we read of air, water and land pollution as well as the possible consequences of the population explosion. To be sure, man has learned that the life necessities provided him by the earth can no longer be looked upon as being inexhaustible. Furthermore, as humbling as it may be, man must also learn that, biologically speaking he is no different than the rest of the organisms on our planet.

The challenge of maintaining a quality environment is certainly a dormidable one but, by no means one which cannot be conquered. The ultimate determiner of success, however, is whether we will meet this challenge intellectually and immediately, and not let it pass us by. To permit it to do so could be disasterous.

Any attempt to meet the challenge of maintaining a quality environment must be centered in a society that is not only well educated ecologically but also, that possesses an ecological conscience This concept is the basic philosophical rationale behind the instructional meterials contained within this book.

These materials represent the combined efforts of many creative educators whose awareness of the need to conserve our natural resources has led them to a commitment in environmental education.

The fundamental premises underlying the writing and use of these materials are an interdisciplinary one. The first of these is that an understanding of the inherent values of our natural resources must become a part of existing curricula. Such understandings must involve a primary through senior high curriculum approach in order to develop a population capable of serving of the environment. The second is that a better way to develop these understandings and inculcate these values is through an "open-ended" or "discovery" approach. Those using these materials will find no answers given. The teacher will, in many instances, be "discovering" along with the students. This is only possible if the teacher is willing to admit that he or she does not have all the answers and that through a variety of procedures solutions to problems may be obtained. Teachers exploring this method will share with their students a new enthusiasm and curiousity for learning. The third premise is that teachers must learn to use these materials. One must be nurtured in both the "open-ended" approach and the ecological complexities existing in the outdoor "classroom".

Generalizations have been "specially" developed, i.e. they are reinforced by concepts of increasing complexity at each higher grade level. The central theme of this development is "man's relationship to his environment". Concepts and generalizations are not to be presented as such. Rather students should be lead toward an understanding through use of suggested questions and activities carefully selected by the teacher. The teachers are expected to adopt these materials in toto, and are to be used as core curriculum guides.

They are to supplement and enrich present curricula by adding a dimension in environmental education.

Outdoor activities are asterisked and teachers are encouraged to use their own school grounds as well as other natural areas that may be available in the use of these activities. Teachers are also encouraged to suggest new outdoor activities and/or make improvements in existing activities.

Specific instructional materials are suggested throughout this book. However, to make a specific lesson even more meaningful teachers are encouraged to make their own over-head transparencies or to use those that may be commercially available. Some of the commercial sources which the Environmental Education Center feel should be considered are:

Keuffel and Esser Co. (Transparency Masters)
Hoboken, New Jersey

Ward's Natural Science Est., Inc. (Transparency)
P.O. Box 1712
Rochester, New York 14603

Osalid (Transparency Masters)
Osalid Division
General Anilene and Film
Johnson City, New York

Instructo Corp. (Transparency)
Paoli, Penna.

The Nolde Forest State Park Environmental Education Center sincerely hopes that these materials will not only prove to be a significant contribution to a school's curriculum but also will help to develop a citizenry that is concerned about its environment.

PERFORMANCE OBJECTIVES

1. To help students increase their awareness and appreciation of the value of natural resources and the need for preserving and improving the quality of the environment.

2. To provide opportunities for pupils to develop and improve their skills and techniques in using their environment properly.

3. To help the student to accept responsibility to maintain or make wise use of his environment in order that other people now and in the future can get maximum benefits from the enviornment.

4. To increase student appreciation and understanding of the interdependence and interrelationship of the environment.

5. To provide student with the basic environmental knowledge which will allow him to present possible solutions for environment problems.

GENERALIZATIONS	PRIMARY	INTERMEDIATE
I. All organisms are interrelated and interdependent.	A. Organisms depend on their environment for the conditions of life. B. Plants are directly or indirectly the source of all food for man and other animals. C. Living things are alike in some ways and different in others, but man groups living things according to their similarities.	A. Communities of living organisms are dependent upon their environment. B. Many living organisms are able to survive only in certain habitats. C. Living organisms occupy a certain niche in their environment.
II. Solar energy runs all ecosystems. Matter within ecosystems is cyclic, while energy is dissipated and must be continually supplied.	A. The original source of energy for all life is the sun. B. The use of light energy by green plants is basic to the growth and maintenance of all living things. C. The seasonal changes of earth affect life.	A. The heat and light of the sun are necessary for life on earth. B. The use of solar energy by green plants is basic to growth and maintenance of life. C. The matter cycles are essential to life.
III. There are biological activities that are characteristic of living organisms.	A. Organisms reproduce their own kind. B. All living organisms respond to stimuli. C. All organisms have some form of movement.	A. All living organisms need nourishment. B. Living organisms must reproduce in order to continue the species. C. All living organisms react to their surroundings.
IV. Life cannot be static. It must adapt and evolve, or perish.	A. Biotic and physical changes may be harmful to the continuing existence of living organisms. B. Changes in environment affect the life, growth and development of living organisms.	A. The life cycle of an organism is adapted to its special environment or habitat. B. When an organism's environment changes, it must adjust or perish. C. The more specialized the organism, the greater the

GENERALIZATIONS	PRIMARY	INTERMEDIATE
		difficulty it will have adjusting to a change in environment.
V. Biological and physical factors will define the limitations of organisms.	A. Some things make food and some eat food but the amounts made and eaten must be balanced within the community. B. Plants and animals can live only in certain places. C. Some animals are very different from other animals and some plants are very different from other plants. Because they are different they live in different places.	A. Physical conditions determine growth. B. Biological factors will define the limitations of organisms. C. Some plant and animal populations in a given area may change with time.
VI. The enormous power of man to affect whole ecosystems is of great importance to the future of the biosphere.	A. Man changes ecosystems for his own purposes, the results being either beneficial or harmful. B. When man changes his natural surroundings the disadvantages may outweigh the advantages over the years. C. Man must take care of his natural surroundings both for today and the future.	A. Man affects the reservoir of air, water, and food essential to members of the ecosystem. B. Man affects the habitats of organisms. C. An appreciation of the beauty contained in our environment is necessary for our present and future well-being.

PRIMARY SCIENCE

I. ALL ORGANISMS ARE INTERRELATED AND INTERDEPENDENT.

A. Organisms depend on their environment for the conditions of life.

QUESTION

1. What is an environment?

   a. Is a pond an environment? For what reasons?
   b. Is a forest an environment? For what reasons?
   c. Is a field an environment? For what reasons?
   d. What things do you find in all three of those places?

2. What plants and animals are found in each of these places?

ACTIVITY

*1. Explore the environments that are part of a natural area (field, forest and/or pond). Develop an experience chart from the comments of the students. This activity on the Primary level can be exploratory as well as directed. Comments can serve as a basis for questions and specific activities concerning these environments.

*2. (Pond Environment) Investigate a pond environment. Using strainers to sift and white enamel pans to collect examine the living organisms in the pond. Do not overlook the small organisms to be found in the strainer after sifting the mud. Also do not forget to fill the enamel pan with water to sustain the aquatic organisms. Sampling at various times of the day can be a part of this investigation. Seasonal changes can be recorded. What differences are seen in the environment at various seasons? (An effort should be made to return at another season of the year).

*3. (Forest and/or Field Environment). Explore a specific portion of the forest and/or field environment by investigating the material and living organisms found within a rope ring made from about 36 inches of rope. Each student can have his own rope ring and be responsible for the area enclosed in his ring.

QUESTION

a. How do these living organisms help each other?

ACTIVITY

*a. In the field (or Forest or pond) environment have

students make assumptions about the food habits of the animals they have observed. In addition, encourage children to point out evidences of animals food habits in the field (or forest or pond). Some examples would include a spider capturing an insect, an insect eating a leaf, or a bird eating a seed.

QUESTION

b. How do dead organisms help living organisms?

ACTIVITY

*b. Have students look for decomposition in stumps, fallen trees, standing dead trees, dead animals (DECOMPOSITION - Breading down of dead organic matter into its constituent elements. e.g. leaves breading down after they have fallen from a tree). Once students have had an opportunity to observe decomposition, they should discuss in the field if possible, how dead organisms contribute to the environment (e.g. production of soil). Students should also compare and contrast a decomposing tree and a newly fallen tree.

QUESTION

c. What physical conditions affect plants and animals in the place where they live?

ACTIVITY

*c. Investigate the sounds of the environment by conducting several "Soft Shoe"[a] walks at various times of the day. Have students decide at what part of the day the greatest amount of activity is heard. Students should also compare such things as temperature and amount of light occuring at various parts of the day and compare these observations with the amount of activity heard. Students should also try to determine what groups of animals are the most vocal in the environment under consideration.

A small portion of an environment can be controlled by varying the physical features.

Have the students design an investigation studying how varying degrees of light and/or moisture effect the life of a green plant.

Example: Light variation: Isolate plants of the same species placing each one the same distance from a light bulb of a different wattage. Have the students examine each plant periodically to ascertain the effects of the varying amounts of light.

Example: Moisture variation: Provide one plant of the same species with one cup of water daily, a second 2 cups daily, a third 3 cups daily and observe effects after a period of time. (Attempt to have all plants approximately the same size and contained in similar containers).

[a] Refer to appendix for description.

For both light and moisture experiments one plant (the control) should be included which would grow under normal conditions.

QUESTION

3. How do seasonal changes affect these places?

ACTIVITY

*3. Have small groups of students adopt a tree. Have the students observe and record the changes over a period of time. How does the tree change with the seasons? How do animals depend on your trees? Keep a written record.

Have group of students adopt different portions of the environment for seasonal observation. Comparisions can be made among the adopted portions. How is our portion different from yours? In what ways are ours alike?

FOLLOW UP ACTIVITIES

1. Construct a terrarium or aquarium for use in the classroom. This can be used during the entire year to observe the development and balance necessary in an environment. What conditions in the terrarium or aquarium are necessary for the survival of the living organisms?

2. Make dioramas that show seasonal changes in the environment. Art projects can be directed toward this activity; painting, drawings, murals, etc.

3. Make a mural depicting the "Web of Life" to show interdependencies of plants and animals in nature. Each member of the class can contribute to this. Small diagrams can be duplicated for each class member.

4. A flannel board can be used back in the classroom after the field trip to illustrate the "Food Chain" and the "Water Cycle". The flannel parts can represent typical animals and plants in the arboretum.

5. Show film "Living Things are Everywhere", Encyclopedia Brittanica Films, 1964 D.C.R.I.M.C., S.S.A.V.L., Ind.

B. Plants are directly or indirectly the source of all food for man and other animals.

QUESTION

1. What would happen to animals, including people, if there were no plants?

ACTIVITY

1. A flannel board presentation can be made showing the "Food Chain". The chain includes the green plants as producers. This will include the animals which consume plants.

QUESTION

2. What do animals, including people, eat that does not come from plants?

ACTIVITY

2. Gather pictures from magazines showing all kinds of foods. On a large chart place these in two columns showing direct and indirect sources of food. Have students discuss which of these foods came from plants directly and which did not.

*2. In the field have students look for evidences of animals eating other animals (e.g. Birds capturing worms or insects, spiders capturing insects, owl pellets containing fur and bones, etc).

QUESTION

3. What is a food chain?

ACTIVITY

*3. On a trip to the forest and field have the students develop a food chain. Using their powers of observation have the students discuss what animals use plants for food (e.g. insects, small rodents) and likewise what eats these insects and rodents (e.g. frogs, snakes, birds or other appropriate animals representing secondary consumers).

QUESTION

a. How are plants part of a food chain?

ACTIVITY

a. A flannel board presentation can be made showing the "Food Chain". The chain should include the fact that green plants are producers, i.e. organisms that utilize solar energy (sunlight) to produce organic material from inorganic matter.

QUESTION

b. How do the plants of the pond contribute to the food chain?

ACTIVITY

*b. Collect pond water containing algae and other plant life. Examine water closely in the field using magnifying glasses and/or binocular microscopes. The magnifying glasses and microscopes will enable the students to see small living organisms. Have the students hypothesize who uses the plant life for food after they have carefully examined the water, giving their reasons why.

This activity can be supplemented with murals or diagrams made by students depicting the chain.

QUESTION

c. How can a dead tree contribute to the food chain?

ACTIVITY

*c. On a field trip to the forest have the students examine a fallen tree trunk that has begun to decompose.

Investigate what animals are living in the log as well as what eventually will happen to log (decompose to soil providing materials for new plants to grow on).

QUESTION

4. How could a drought affect food sources?

ACTIVITY

4. Set up an experiment where one plant would be given a sufficient amount of water, another a reduced amount, and a third no water (all plants should be of same species). Have students examine each plant on a daily basis for a couple weeks and then reach a conclusion about the effects observed.

C. Living things are alike in some ways and different in others, but man groups living things according to their similarities.

QUESTION

1. What are living things? How would you know if something was alive?

ACTIVITY

1. Display some small live animals and some non-living objects such as a rock, pencil, or dead insect. Let the children discuss and list on board differences between living and non-living things.

Make a bulletin board with pictures of living and non-living things. Underneath list the characteristics of both living and non-living things.

*1. On an outdoor field trip have the students classify the objects they see as living and non-living. Students should discuss why they have placed an object into one or another category.

QUESTION

2. What things are classified as plants?

ACTIVITY

*2. Take a trip to the woods to discover the characteristics of plants. Let the children make sketches of trees, grasses, and shrubs, then make a scroll movie from the sketches with appropriate labels beneath them. Have children discuss why these are all plants. (What characteristics are similar?)

QUESTION

3. What do non-green plants have in common?

ACTIVITY

*3. On a field trip have the students explain how non-green plants are similar to one another. Have them observe not only the physical features of the plant itself but also of the environment in which the plant lives (e.g. moist or day; in sunlight or not in sunlight, etc.)

QUESTION

4. What do green plants have in common?

a. What are some characteristics of trees?
b. How are grasses alike?
c. What are the differences between shrubs and trees?

ACTIVITY

*4. (a,b,c,) Have students examine as many green plants as possible in the field and have them illustrate the characteristics which are common to all. Also have students illustrate the differences among the plants. (e.g. compare shrubs to trees, grasses to trees).

QUESTION

5. In what ways are animals alike?

ACTIVITY

*5. Make a trip to the woods to observe wildlife. Have the children notice the likenesses among animals. Have students hypothesize why certain living things are classified as animals.

QUESTION

6. In what ways are animals different from each others?

   a. What do birds have in common?
   b. What do reptiles have in common?
   c. What do mammals have in common?
   d. What do insects have in common?

ACTIVITY

*6. On a trip to the field and/or forest have students classify (group) animals according to their similarities. That is, have students make observations of various animals and have them make assumptions about which animals are most closely related and illustrate how so (by pointing out similarities of physical structure).

FOLLOW UP ACTIVITIES

1. Put on a skit, in simple costume, involving the animals of the forest showing their different habits and other characteristics. Let the children write their own play involving these animals.

2. Play "Match Game" where a student picks from a list of suggestions and portrays a certain animal of the forest for others to guess.

3. Have children write poems about different animals and plants incorporating such things as: particular animals, movement, appearance, homes, etc.

4. Read the "Ugly Duckling" as a story to point out that the duck does not feel as though he is part of the group because of his odd characteristics.

5. Show film "Birds of the Countryside" Cornet Films.

6. Show film "Common Animals of the Woods" Encyclopedia Brittanica Films.

INSTRUCTIONAL MATERIALS

Films: (16 mm.)

"Animals and Their Homes", Ind., D.C.R.I.M.C.
"Animals are Different and Alike", D.C.R.I.M.C.
"Animal Communities and Groups", Ind.
"Animal Homes", S.S.A.V.L., Syr., Ind.
"Birds of Our Storybooks", D.C.R.I.M.C., Syr., Ind.
"Birds of the Countryside", D.C.R.I.M.C., Syr., Ind.
"Common Animals of the Woods", D.C.R.I.M.C.
"Life in the Forest", D.C.R.I.M.C., Syr., Ind.
"Life in a Pond", Syr., Ind.
"The Life Story of a Plant", (planning stage).
"The Life of a Tree", (planning stage)

"Living Things are Everywhrre", D.C.R.I.M.C., S.S.A.V.L., Ind.
"One Rainy Day", D.C.R.I.M.C., Syr., Penn State.
"Pond Life", Syr., Ind.
"A Tree is a Living Thing", D.C.R.I.M.C.
"We Explore the Woodland", Syr.

Filmstrips:

"Animal Babies and Families", (Eyegate)
"The Frog (Life Cycle"), Stanbow Productions, Inc.

II. ENERGY FROM THE SUN RUNS ALL ECOSYSTEMS. MATTER WITHIN ECOSYSTEMS IS CYCLIC, WHILE ENERGY MUST BE CONSTANTLY SUPPLIED.

A. The original Source of Energy for All Life is the Sun.

QUESTION

1. What is energy?

ACTIVITY

1. Have a student demonstrate what happens to a battery operated toy when the batteries are removed. Have the students hypothesize what the batteries do for the toy. (Make it "work", give it energy).

QUESTION

2. Why is the sun necessary for life? What would happen if the sun permanently disappeared?

ACTIVITY

2. Deprive some plants of light for several days. Grow some of the same kind of plants under normal conditions. Record the observations and compare both groups. (Sunlight does something to plants to make them "work").

QUESTION

3. How do all living things receive energy? Where is energy stored?

ACTIVITY

*3. Have the children discuss prior to field trip what makes animals "work", including man. Students could bring in pictures of various types of food.

Have students take a field trip and point out sign of or actual examples of animals involved in food gathering Insects eating leaves, birds eating seeds, spiders capturing prey in web).

3. Show various edible plants (carrots, potatoes, turnips) that grow their edible portions below the ground. How do these plants make use of sunlight?

QUESTION

4. What happens to plants that receive no sunlight or any light?

ACTIVITY

4. Germinate seeds in total darkness. Obtain seed from mature plant. Place seed and mature plant in darkness. Observe result after a week. Record these observations.

QUESTION

5. What functions other than biotic depend on the sun?

ACTIVITY

5. Have students observe what happens to a thermometer placed in the sun.

FOLLOW UP ACTIVITIES

1. Show film "Conditions that Exist for Life" Pa. Dept. of Education D.C.R.I.M.C.

B. The Use of Light Energy by Green Plants is Basic to the Growth and Maintenance of all Living Things.

QUESTION

1. What is the source of light energy?

ACTIVITY

1. Show the effects of light energy through the use of a magnifying glass on combustible materials such as paper, leaves, etc. Have students hypothesize what happened.

QUESTION

2. How do green plants use light energy?

a. What would happen if a green plant would be deprived of sunlight?

ACTIVITY

*a. Investigate the effects of sunlight on leaves by placing black construction paper or aluminum foil over some of the leaves. Notice the difference between the covered and uncovered leaves after the foil has been taken off after a few days.

QUESTION

b. How do varying amounts of light effect the growth of plants?

ACTIVITY

*b. Investigate the effects of sunlight on leaves by placing black construction paper or aluminum foil over some of the leaves. Notice the difference between the covered and uncovered leaves after the foil has been taken off after a few days.

QUESTION

c. How do animals benefit from green plants?

ACTIVITY

*c. Feed green plant products (lettuce leaves or sunflower seeds are good) to animals such as a hamster or mouse. Through this activity develop the idea of the food chain whereby the mouse eats a plant and it in turn is eaten by something else.

QUESTION

d. How do green plants help non-green plants?

ACTIVITY

*d. Examine a bracket fungus on a tree trunk. What color is it? Where does it seem to get its food? Is it directly or indirectly effected by the sun? Would you classify it as a green plant? Why or why not?

Grow mushrooms or another fungus in a dark area. Use bread or mushroom soil. Do non-green plants require light energy?

QUESTION

3. In what ways are leaves basic to a tree's survival?

a. In what ways are leaves similar?
b. In what ways are leaves different?

ACTIVITY

*a. & b. On a field trip observe and record data about leaves in the field including such things as color, texture, broad or needle-leaves, size, etc.

QUESTION

4. What is needed for seeds to germinate?

ACTIVITY

4. Germinate seeds under various conditions. Grow some in light and some in darkness. Water some seeds and let others remain dry. Try to vary the temperature setting for some seeds. Use different kinds of soil in which to grow seeds. Record observations.

FOLLOW UP ACTIVITIES

1. Play a food chain relay game using cards. Place 5 cards down on the floor with the students about 25 feet away. Make a statement such as this: "Which one of the 5 sources of food shown on the cards is the one which a rabbit eats?" Then on the signal "go", the student who first reaches the correct card and takes it back to his starting position scores one point for his side.

C. The seasonal changes on earth affect life.

QUESTION

1. How does the change of seasons affect life in your own surroundings?

   a. How does a change of seasons influence your activities?
   b. How does a change in seasons affect your family?
   c. How does a change in seasons decide the type of clothing you wear?

ACTIVITY

1. Form a committee of four children representing the four seasons. Let each child show by costume or poster which season he represents. Have each child tell by poem, story, or report how seasonal changes affect life within the human family.

QUESTION

2. How do changing seasons affect life in the forest, and in the pond?

   a. What signs of the changing season are seen in animals in late fall? in winter? in spring?
   b. What changes occur in pond life in each of the four seasons?
   c. What changes occur in a forest in each of the four seasons?

ACTIVITY

*2. Plan four trips to the woods and pond in (1) late fall (2) mid-winter (3) early spring (4) late spring (nearing summer). On the first trip select a forest area and observe it as it appears in fall. Keep careful records. Return to this same area each season to discover the effects on season changes. Record all findings. Have children illustrate how seasons affect life in forest.

QUESTION

3. How do changes of life in one season affect life in the following season?

   a. How do some animals and plants change physically in fall?
   b. How will these changes affect their lives in winter?
   c. What effect does the production of new life in the spring have on life in the summer?

ACTIVITY

*3. On a field trip have the students discover what seasonal changes have taken place and what effect these changes would have upon life. (Leaves falling from plants, animals develop

thicker fur in autumn in preparation for winter, depletion of thick vegetation exposing animals' hiding places).

FOLLOW UP ACTIVITIES

1. Have students discuss the following questions.

   a. Which season or seasons do you think make(s) life easiest for all living things? Explain your thinking.
   b. What different things do you think could be observed on a nature trip in winter?

2. Show the film "Seasons of the Year" Cornet Film.

III. There are Biological Activities that are Characteristic of Living Organisms.

A. Organisms reproduce their own kind.

QUESTION

1. How are baby animals like their parents?

ACTIVITY

1. Bring to the classroom animals that will soon bear young and compare to adults when born. Examples of this could be mice, chickens, guppies.

*1. Make a report on any personal observations of newly born creatures i.e., kittens, spiders, puppies, guppies.

QUESTION

2. How are young plants like their parent plants?

ACTIVITY

2. Make a collection of various seeds and match them with pictures of the mature plants.

*2. On a field trip to the woods have students compare seedlings to mature plants.

QUESTION

3. Why don't the young resemble their parents at all times?

ACTIVITY

*3. On a field trip to a pond[a] habitat have the students compare and contrast the egg, tadpole, and adult stages of the frog (have students look at physical features of each stage and hypothesize why they look different from the adult as well as why each stage may be found in a slightly different environmental habitat). The same can be done with the stages of various insects e.g. dragon fly, butterfiles, moths, etc.

QUESTION

4. How do plants reproduce?

[a] Refer to appendix for description

ACTIVITY

*4. On a field trip, collect seeds from various plants. (Do not allow students to buy packaged seeds). What do you think will grow from each seed?

QUESTION

5. What characteristics are common to all animals?

ACTIVITY

*5. On a field trip have students compare and contrast the plants and the animals found. Have the students explain how they determine that an organism is an animal.

QUESTION

a. What characteristics do fish have in common?

ACTIVITY

*a. On a field trip to a pond[a] or stream have the students compare and contrast fish observed with other animals present. Have children explain how they know that an animal is a fish.

QUESTION

b. What characteristics do birds have in common?

ACTIVITY

*b. On a field trip in the out-of-doors have the children observe the physical characteristics and habits of as many birds as possible. Have children use their observations to answer the following question: Explain how you know that an animal is a bird and not a fish or an insect, or a dog?

QUESTION

c. What characteristics do cats and dogs have in common?

ACTIVITY

*c. Have the students observe a dog and a cat together and explain how the two animals are alike.

QUESTION

6. Why is it necessary for living organisms to reproduce?

[a]Refer to appendix for description

ACTIVITY

*6. On a field trip have students look for seeds and the plants from which they came. Have students hypothesize what could happen to the seeds. Have the students then explain what would happen if a plant made no seeds. Finally have students discuss what would happen to animals that would eat the plants if the plants no longer made seeds.

FOLLOW UP ACTIVITIES

1. Play "Who Am I" game using animal characteristics as clues. Example: make ditto showing a baby animal or plant and four different adults, one of which they will pick out as the parent.

2. Show film "Seeds Grow Into Plants" Corent Films, 1955.

3. Show film "Seed Dispersal" Encyclopedia Brittannica Films, 1957.

4. Show film "Animals in Spring" Encyclopedia Brittannica Films.

B. All Living Things Respond to Stimuli.

QUESTION

1. What are the senses that help to tell you about the things around you?

ACTIVITY

1. Develop with the class a small area or center that contains materials for stimulating the senses.

QUESTION

a. How do your eyes help you to find out about the things around you?

ACTIVITY

*a. Sight materials - blindfold, materials to be identified.

QUESTION

b. How does your tongue help you?

ACTIVITY

*b. Materials that look alike, but don't taste the same, i.e., sugar water and salt water to be identified.

QUESTION

c. How does your nose help you?

ACTIVITY

*c. On a field trip to the out-of-doors have students investigate the smells of various plants e.g., onion grass, spice bush, pine, sassafras, honeysuckle flower, yarrow.

QUESTION

d. What do we find out with our ears?

ACTIVITY

*d. On a field trip to the woods have the students identify various sounds that they hear as well as attempting to locate the source of the sounds e.g., birds, insects, animals rustling, leaves, wind, etc.

Have students distinguish man-made sounds from those made by animals.

QUESTION

e. Does your skin help you know if something is hot or cold: rough or smooth?

ACTIVITY

*e. On a trip to the out-of-doors have students describe various items found by the way it feels e.g., rough, smooth, hard, soft, hot, cold, wet, dry, etc. (Bark, leaves, twigs, rocks, soil, animals, etc.)

Students may also compare the feel of two similar objects e.g., a leaf that has fallen in the autumn to one that is still attached.

QUESTION

2. What senses do animals have that help to protect them?

a. How does a bird sense that you are coming near to him?
b. How do a rabbit's senses help to keep him from harm?
c. Why is it difficult to catch a fly with your hand?

ACTIVITY

2. Make a list of common sayings that relate to animal senses.

a. Eyes of a hawk.
b. Nose like a blood hound.
c. Blind as a bat.
d. Timid as a rabbit.

*2. On a field trip to the woods, have the students test some of the sayings developed.

QUESTION

3. In what ways do plants respond to their environments?

a. How do plants respond to light?

ACTIVITY

*a. Have students examine undergrowth of forest and field. Students should compare and contrast the growth in each area as well as the available light.

QUESTION

b. How do plants respond to the changing seasons?

ACTIVITY

*b. Students should choose an area around their school which can be observed on a seasonal basis. Students should compare and contrast the effect that the various seasons have on grasses, trees, flowers, mosses, lichens, ferns. (Consider color; presence of leaves, flowers, buds; presence of plant itself.)

C. All Organisms have some form of Movement.

QUESTION

1. How do plants move?

ACTIVITY

1. Conduct several activities in the classroom which demonstrate response to lights. Plants can be placed in shoe boxes that have a hole in one end. Record observations over several days.

1. Demonstrate response to water by putting some moist soil in a box. Place several potted plants in plugged flower pots in the soil. Water only one. Observe for ten days and record.

*1. On a field trip look for examples of responses of trees to light and water. Look at the trees that are responding to sunlight. Examine the roots of trees along streams and observe how they have responded to water. Will the trees in the low moist area have deep roots or shallow roots? Do green plants floating in or on the pond have roots? Do they move? How?

QUESTION

2. How do animals move?

ACTIVITY

*2. During a forest ramble observe the movements of various animals. How do birds move? How do insects move?

QUESTION

3. Why do living things move?

ACTIVITY

*3. On a field trip have the children speculate and demonstrate if possible why animals and plants move (e.g. to get food, to move away from danger, to migrate to warmer climate, etc.)

FOLLOW UP ACTIVITIES

1. Tell the fable of "The Tortoise and the Hare".

2. Show the film "Movement of plants" Cornet Films.

INSTRUCTIONAL MATERIALS

Films: (16mm.)
"Animals: Ways they Move", Ind.

"Living and Non-living Things", Syr., Ind.
"Seeds Grow Into Plants", Syr., Ind.
"Your Friend the Forest", D.C.R.I.M.C., Syr., Ind.

IV. LIFE CANNOT BE STATIC: IT MUST ADAPT, EVOLVE, OR PERISH.

A. Biotic and Physical Changes May be Harmful to the Continuing Existence of Living Organisms.

QUESTION

1. How can biotic changes affect the existence of living organisms?

   a. What effect does the Dutch Elm Disease have on the Elm Tree?
   b. What effect has the chestnut blight on the American Chestnut?

ACTIVITY

*1. Take a trip to the woods and observe the conditions of the American Elm and American Chestnut Trees. What seems to be destroying them? Why don't you see many of these trees?

QUESTION

2. What are some of the things that can happen to plants that cause them to die?

ACTIVITY

*2. On a field trip look for lightning, fire, water, animal and man-made damage.

QUESTION

3. What are some of the things that can happen to animals that cause them to die.

ACTIVITY

*3. On a field trip have children examine food sources of animals an hypothesize what would happen if these sources were absent (e.g. berries as food for birds).

*3. Have children look for predator-prey relationships on field trip. (spider eating insects). Have children hypothesize what would be the effects of an animal having no prey.

*3. Have students look for animal habitats and hypothesize what would happen if the habitat was destroyed (e.g. logs, holes, nests, etc.)

*3. Have students look at areas affected by man and hypothesize whether changes seen are helpful or harmful to animals in the area. (e.g. building of a road, house, apartments, etc.)

QUESTION

4. How can some plants and animals live while others die?

ACTIVITY

*4. Have students look under a maple tree and note the number of seeds that have fallen. Students should look for seedlings that have sprouted. Students should hypothesize why some seeds sprouted and others not (consider conditions needed for seed to grow into a plant).

*b. Set up a bird feeding station outside of the classroom window and keep it supplied with sunflower seeds and cracked corn. Have students observe the activities of birds at the station and try to determine whether some of the birds have established their own territory around the feeder. (Note how some birds may attempt to chase others sway).

QUESTION

5. What does man do to cause plants and animals to die?

ACTIVITY

*5. On a field trip to the woods have the children hypothesize what happens to an area if someone walks over plants, pulls leaves from the trees, cuts down trees, bulldozes an area, throws trash over an area, dumps chemicals, builds a structure.

Pick out a specific area. Have children examine the plants and animals which comprise the area and have them hypothesize which ones would be remaining after the aforementioned events would take place.

FOLLOW UP ACTIVITIES

1. Collect pictures of dinosaurs, passenger pigeon, whooping crane, great auk, buffalo, golden eagle, etc. and discuss their plight and steps needed to save those still in existence.

2. Obtain pictures or slides of areas, such as the Great Lakes, that have been altered due to a physical change. Other areas would include beaches where erosion is taking place, the Grand Canyon, glaciers, etc.

3. Show film "How Animals Live in Water" Cornet Films.

B. Changes in Environment Affects the Life, Growth and Development of Living Organisms.

QUESTION

1. What kinds of changes in natural surroundings will effect the lives of plants and animals?

ACTIVITY

*1. Adopt a particular area and note the effects of seasonal changes in that area. How does the plant life seem to differ from season to season?

*1. On a field trip compare a field to a forest area. How does it differ from the forest edge? What kinds of animals live in the forest that don't live in the field? Has the field ever been a forest?

QUESTION

2. When the natural surroundings of plants or animals change, what does the plant or animal do?

ACTIVITY

*2. Examine a decomposing tree stump. Notice how it has changed. How does the soil look and feel about it? What plants and animals do we find living or eating about the stump? What would happen if a tree stump did not decay?

*2. Take a jar of water from a stream after a rain. Examine the amount of soil in the water. Where does this soil come from? What effect does the soil have on plants and and animals in the stream or pond? What can we do to prevent soil from entering a stream?

QUESTION

3. If changes were continued what do you expect would happen to the plants and animals?

ACTIVITY

*3. Take a jar of water from a stream after a rain. Examine the amount of soil in the water. Where does this soil come from? What effect does the soil have on plants and animals in the stream or pond? What can we do to prevent soil from entering a stream?

*3. Create a small scale pond in an aquarium and fill each day with some debris. Watch the pond fill up until it is no longer

a pond. (If possible, try to relate this to ponds observed on field trips).

*3. Make a scrapbook with a collection of pictures showing long range effects of changes in natural surroundings on organisms.

FOLLOW UP ACTIVITIES

1. Show following films:

"Animals in Summer", Encyclopedia Britannica Films.
"Animals in Winter", Encyclopedia Britannica Films.
"Animals in Autumn", Encyclopedia Britannica Films.
"Animals in Spring", Encyclopedia Britannica Films.

V. BIOLOGICAL AND PHYSICAL FACTORS WILL DEFINE THE LIMITATIONS OF ORGANISMS.

A. Some things make food and some eat food but the amounts made and eaten must be balanced within the community.

QUESTION

1. What is meant by "balance"?

ACTIVITY

1. Let students discover the meaning of balance on a teeter-totter or by balancing objects on a yardstick centered on a rolling pin. Let them explore the producer-consumer concept under your direction.

QUESTION

2. Where does your family get food?

ACTIVITY

2. Have students develop a poster illustrating the types of food that they eat.

2. Students should classify these types of food into animal and plant categories.

2. Students should determine whether food type was grown in the ground or raised like cattle.

2. Students should discuss from where the grocery store obtains food.

QUESTION

3. What would happen to your family if they could not get any food?

ACTIVITY

3. Compose and perform a skit that illustrates the balance between production and consumption of food in the home.

QUESTION

4. What would happen if you could not eat all of the food your family bought?

ACTIVITY

4. Compose and perform a skit that illustrates the balance

between production and consumption of food in the home.

QUESTION

5. Where do trees get their food?

ACTIVITY

5. Obtain two coleus cuttings. Root them in water. "Feed" one with water-soluble plant food (obtainable in any "five and ten") and do not feed the other. Let students observe and discuss results.

QUESTION

6. Where do animals get their food?

ACTIVITY

*6. Have the students identify various areas that will support consumers, and have them identify the consumers that they see or hear.

*6. On a field trip have students observe animals feeding or look for signs of animals feeding (chewed leaves, nuts, kill sites, etc.) Have children hypothesize what would happen to the animals if certain food sources were not present.

QUESTION

7. What would happen if trees and animals couldn't get food?

ACTIVITY

7. Play a game that involves the children representing animals and each animal type selecting the food from a group of foods that he would probably consume. Gradually elminate the balance by eliminating certain foods. The children (animal types) that can no longer consume must sit down. The last one up is the winner.

QUESTION

8. What happens to plants and animals after they die?

ACTIVITY

*8. Take a field trip to woods and field. Look for examples of nutritional advantages and disadvantages. Study decaying logs and stumps. Look for fungi and discuss their role in nature's "balance".

FOLLOW UP ACTIVITIES

1. Make a bulletin board that shows prime producers and consumers.

B. Plants and animals can live only in certain places.

QUESTION

1. What are some of the animals that live in your neighborhood?

ACTIVITY

*1. Take a field trip around your school or to a nearby woods, field, and/or pond. What animals can you see. Which ones live in the woods and which live in the field? Which live in the pond? Could they change places? Why or why not? Did you find lions and tigers on your trip? Why or why not?

QUESTION

2. Which of the animals in your neighborhood live in houses as pets?

ACTIVITY

2. Have the students develop a list of animals that live in houses as pets. Students should hypothesize whether these pets could also live naturally outside their homes. Why or why not? Where?

QUESTION

3. What are some of the plants that grow in your neighborhood?

ACTIVITY

*3. Take a field trip around your school or to a nearby woods, field and/or pond. What plants can you see? Which ones grow in the woods and which grow in the field? Which grow in the pond? Could they change places? Why or why not? Did you find palm trees on your trip? Why or why not?

QUESTION

4. Which plants do you find in homes?

ACTIVITY

4. Have the students develop a list of plants found in the home. Have the students hypothesize whther these plants could live naturally outside their homes. Why or why not? Where?

QUESTION

5. What do the animals found around your neighborhood do in the winter?

ACTIVITY

*5. On a winter field trip to field and/or woods students should investigate what animals are present (by direct observation or by signs). Students should compare what was found to what may be found at a different season and hypothesize what happened to those animals which would be present during a different season. (Did they migrate? Have insects laid their eggs in places which are not self-evident to us e.g. burdock).

QUESTION

6. What do the plants found around your neighborhood do in the winter?

ACTIVITY

*6. On a winter field trip to field and/or woods students should investigate what plants are present. Students should compare the plants found to what would be found at a different season and hypothesize what happened to them. (Students should look for evidences of these plants such as seeds).

QUESTION

7. Do you think any of these plants or animals found in your neighborhood could live at the North Pole? Why or why not?

ACTIVITY

*7. Have the children on a field trip determine how animals protect themselves from the elements in their area (fur covering, etc.)

*7. Have students compare the physical characteristics of the animals around their neighborhood with animals found in an Arctic climate.

QUESTION

8. Where would you go to find lions, tigers, elephants, orange trees, and palm trees? How come they don't live in your neighborhood?

ACTIVITY

*8. Have the students determine where they would find these organisms. Students should compare the climates of areas in which these animals and plants are found with that of their own neighborhood.

C. Some animals are very different from other animals and some plants are very different from other plants. Because they are different they live in different places.

QUESTION

1. How is it that a fish can live under water but dogs and cats cannot?

ACTIVITY

*1. On a field trip look for different plants and animals living in such places as the woods, fields, ponds, streams, formal gardens, on tree trunks, building walls, stones, etc. Have students observe structural adaptations.

QUESTION

2. How is it that birds can fly but mice cannot?

ACTIVITY

*2. On a field trip look for different plants and animals living in such places as the woods, fields, ponds, streams, formal gardens, on tree trunks, building walls, stones, etc. Have students observe structural adaptations.

QUESTION

3. How can dogs, cats, squirrels and birds live in your backyard even though they are enemies?

ACTIVITY

*3. On a field trip look for different plants and animals living in such places as the woods, fields, ponds, streams, formal gardens, on tree trunks, building walls, stones, etc. Have students observe structural adaptations.

QUESTION

4. Why might a cactus plant live longer than a daisy in a place visited by many people?

ACTIVITY

4. Bring cacti and other house plants to class. Have students investigate structural differences. Encourage students to bring in plants or pictures of plants that show special structural adaptations.

FOLLOW UP ACTIVITIES

1. Show film "Dinosaur Age", D.C.R.I.M.C.

B. When man changes his natural surroundings the disadvantages may outweigh the advantages over the years.

QUESTIONS

1. How has man changed natural surroundings in the place where you live?

2. How has man changed natural surroundings in places you have visited?

3. Which changes do you think are "good"? Why?

4. Which changes do you think are "bad"? Why?

ACTIVITY

*1-4. Take a trip to the woods and look for places where man has made changes. Let students tell whether they think these are "good" or "bad" and why. (Similar activities can be used for field, stream, pond habitats).

*1-4 A comparison could also be made between a rural area and an urban area.

FOLLOW UP ACTIVITIES

1. Collect articles from magazines and newspapers that show ways in which man has changed his natural surroundings.

C. Man must take care of his natural surroundings both for today and the future.

QUESTION

1. How can man help to care for his natural surroundings?
   a. What can you do to care for your natural surroundings?

ACTIVITY

*a. During a vasit to the forest, point out examples of good forest manners. Have each member help to remove any litter that may be found.

QUESTION

b. How can you get others to care for their natural surroundings?

ACTIVITY

*b. Make a list of people you would like to help care for their natural surroundings, and tell how you can help.

*b. Have the class write (jointly) a letter to the President or Governor expressing the fact that they are interested in conservation and will do their best to follow good conservation practices and encourage others to do the same.

*b. Invite a Boy Scout who is interested and involved in conservation to talk to the class about how the Boy Scouts (Order of the Arrow) are doing their part for conservation.

QUESTION

c. Is caring for your natural surroundings just what you do, or is it sometimes what you don't do?

ACTIVITY

*c. Make posters that display various aspects of the "Do's" and "Don'ts" of natural surrounding care.

QUESTION

d. What do you think would happen if we let all of our land become shopping centers, or housing developments?

ACTIVITY

*d. Show slides to the group of beautiful natural surroundings. Make a list of the things that would blight or ruin these areas. Based upon this, have the class make (compose) a

promise that they always will care for their surroundings.

*d. Compare local natural areas to areas that are comprised of shopping centers and housing developments. Compare and contrast the animals and plants found in both areas.

See apprndix for:

Pond Investigation
Trip Journal
Rope Ring
Soft Shoe
Rope Ring
Trail Bag

VI. THE ENORMOUS POWER OF MAN TO AFFECT WHOLE ECOSYSTEMS IS OF GREAT IMPORTANCE TO THE FUTURE OF THE BIOSPHERE.

A. Man changes ecosystems for his own purposes, the results being either beneficial or harmful.

QUESTIONS

1. What changes does man make in the natural surroundings?
2. Are these changes beneficial or harmful?

ACTIVITIES

*1-2. On a field trip around the school grounds have the students investigate the area to find out what changes man has made in the ecosystem and discuss the possible advantages and disadvantages of these changes to man and other animals.

*1-2. Take a trip to an arboretum to see how man has made changes to benefit living organisms. Find where man has thinned trees to allow light to penetrate through the forest canopy and where he has put up feeders for birds. Also, have students reflect on the value of the arboretum, as a whole, on living organisms - including people.

1-2. Build a model of a dam. Discuss the reasons for building dams. Let students make a report on beaver dams.

QUESTION

3. What changes in the natural surroundings, that are planned to be helpful to many, are harmful to other living organisms?

ACTIVITY

3. Gather materials for a scrapbook showing man's effect on the ecosystem.

FOLLOW UP ACTIVITIES

1. Put on a dramatization in the out-of-doors stressing conservation. Some of the following are suggested material for plays: Good trail manner, the good and bad hunter, the farmer, the lumberman, and the ranger.

2. Make posters on conservation using as a theme one of the following: Littering, saving our forests, water and air pollution, and safety in the woods.

3. Use resource personnel from the local branch of the Forestry Service for primary resource material.

4. Show and discuss film "The Beaver", E.B.F., Syr., Ind. D.C.R.I.M.C.

B. When man changes his natural surroundings the disadvantages may outweigh the advantages over the years.

QUESTIONS

1. How has man changed natural surroundings in the place where you live?
2. How has man changed natural surroundings in places you have visited?
3. Which changes do you think are "good"? Why?
4. Which changes do you think are "bad"? Why?

ACTIVITIES

*1-4 Take a trip to the woods and look for places where man has made changes. Let students tell whether they think these are "Good" or "bad" and why. (Similar activities can be used for field, stream or pond habitats.)

FOLLOW UP ACTIVITIES

1. Collect articles from magazines and newspapers that show ways in which man has changed his natural surroundings.

C. Man must take care of his natural surroundings both for today and the future.

QUESTION

1. How can man help to care for his natural surroundings?

ACTIVITY

1. During a visit to the forest, point out examples of good forest manners. Have each member help to remove any litter that may be found.

QUESTIONS

2. What can you do to care for your natural surroundings?
3. How can you get others to care for their natural surroundings?
4. Is caring for your surroundings just what you do, or is it sometimes what you don't do?

ACTIVITY

2-4 Make posters that display various aspects of the "Do's" and Don'ts" of natural surrounding care.

QUESTION

5. What do you think would happen if we let all of our land become shopping centers or housing developments?

ACTIVITY

*5. On a field trip take the students to both a natural area and an area which contains shopping centers and housing developments. Have the students hypothesize, while at the natural area what changes would be realized if the area would be developed. Visit the shopping center and housing development areas to have the students either confirm or refute their hypothesis.

FOLLOW UP ACTIVITIES

1. Have the class write (jointly) a letter to the President or Governor expressing the fact that they are interested in conservation and will do their best to follow good conservation practices and encourage others to do the same.

2. Invite a Boy Scout who is interested and involved in conservation to talk to the class about how the Boy Scouts (Order of the Arrow) are doing their part for conservation.

3. Make a list of people you would like to help care for their natural surroundings, and tell how you can help.

INSTRUCTIONAL MATERIALS

Films: (16mm)

"How Birds Help Us", Syr.
"The Beaver", D.C.R.I.M.C., Syr., Ind.
"Vision in the Forest", Ind., Penn State
"Your Friend the Water", D.C.R.I.M.C., Syr., Ind.

INTERMEDIATE SCIENCE

I. ALL ORGANISMS ARE INTERRELATED AND INTERDEPENDENT.

A. Communities of living organisms are dependent upon their environment.

QUESTION

1. What does the word "community" mean and how does it apply to the world of nature?

ACTIVITY

1. Initiate an open discussion on the term "community". After some common understandings have been established, break the class into committees to decide how these understandings would apply to the world of nature. Reassemble to discuss and decide a common concensus. Introduce the term "ecology", and discuss how this term's definition and the understandings of community are similar.

QUESTIONS

2. What are some of the natural communities?
3. How are communities alike?
4. How are communities different?

ACTIVITY

*2-4 Take the class to the woods, the pond, and the field to observe how these communities are alike and how they are different.

a. Pond

1. Is there anything in the water?
2. Are there insects in the water?
3. What is growing along the side of the pond?
4. Can you hear any sounds coming from the pond?
5. Are there large trees growing in or very near the pond?

b. Forest

1. Are there trees of different sizes growing in the forest?
2. Can you hear sounds in the forest?
3. Do you see anything on the forest floor? What?
4. What does the soil in the forest floor feel like?

c. Field

1. Do you notice the same things growing in the field as in the pond? As in the forest? What are the differences?
2. Do you hear any sounds in the field?
3. Does the soil in the field feel any different than the soil in the forest?

QUESTIONS

5. Can a single plant or animal get along all by itself?
6. How are animals dependent on one another?
7. How are plants dependent on one another?
8. Are plants ever dependent upon animals?
9. Are animals ever dependent upon plants?

ACTIVITY

*5-9. Visit an arboretum or a natural area.

a. Observe a tree stump.

1. What is growing on this stump?
2. Do you see anything living in the stump? What?
3. Is the stump decaying? What does this decay feel like?
4. What does the soil feel like around the stump?

b. Observe a dead tree lying on the ground.

1. What is happening to the tree?
2. Is there anything living in the tree?
3. What does the tree look like? What does it feel like?
4. What do you think will eventually happen to this dead tree? To all dead trees?

c. Observe a tree with fungus growing on it.

1. What color is this fungus?
2. What does the fungus feel like?
3. Do you think the fungus helps the tree? In what way might it harm the tree?

d. Observe a tree with algae growing on it.

1. What color is the algae?
2. Do you think the tree is helping the algae? Why or why not?
3. How might the tree be helping the algae?

e. Observe the feeding habits of the animals and insects around the pond.

1. What do you see the insects eating?
2. What might frogs eat?

f. Observe seed dispersal methods.

Have students walk through the woods and fields and examine their clothing. What do you find?

g. Observation of pond life. Scoop some water and mud from pond and separate organisms for study under microscopes. You might notice organisms living on other organisms showing the interrelationships and interdependence.

INSTRUCTIONAL MATERIALS

Films: (16mm)

"A Living Community", (Life in a Vacant Lot)
E.B.F., D.C.R.I.M.C.
"Living Things are Everywhere", E.B.F., D.C.R.I.M.C., Ind.
"Living Things Depend on Each Other", E.B.F., D.C.R.I.M.C.
"Partnerships Among Plants and Animals", Cor., Ind.

Filmstrips:

"Communities of Living Things", McGraw-Hill
"Interdependence of Living Things", McGraw-Hill

B. Many living organisms are able to survive only in certain habitats.

QUESTION

1. What is a habitat?

ACTIVITY

*1. On a field trip to the woods, field, and stream/or pond students should discuss the location where organisms live and give possible reasons for their living there. The following questions may assist in this discussion:

a. Where do frogs live?
b. Where do robins live?
c. Would you ever see a robin living in a pond? Why?
d. Have you ever seen a polar bear living in the woods near your home? Why or why not?
e. Would you see a cactus growing near a stream or pond? Why or why not?

QUESTION

2. Are all habitats similar?

ACTIVITY

*1. On a field trip have the students compare and contrast the physical as well as the biological characteristics of a field, forest, and pond.

QUESTION

3. What does a habitat provide for the organisms living in it?

ACTIVITY

*3. Investigate the contents of a pond.[a]

a. Do you find the same insects living in the pond as in the forest?
b. Might the pond supply the insects with things not found in a forest?
c. Do you find both plants and animals in the pond? Describe them.

QUESTION

4. Do habitats change? How may they change?
5. How would a change in numbers of organisms affect a change in a habitat?

[a]Refer to appendix for description.

6. How would a change in a habitat affect a change in the organisms living in that habitat?

*4-6 Find the results of Dutch Elm disease. Look for the cause of it. What will eventually happen to the elm tree? What will eventually happen to the organism causing the disease?

4-6 Discuss and show pictures of the devastation caused by forest fires. Have students express their ideas on how the change in habitat brought about by natural phenomena affects the organisms in that habitat.

QUESTION

7. Do organisms share habitats? Give examples.

ACTIVITY

*7. Have children, as they visit different habitats, keep a record of the animals and plants living in those habitats.

EXAMPLE:

Grassland	Forest	Pond
Birds	Squirrels	Frogs
Insects	Birds	Dragon Flies
Rag Weed	Beech Trees	Algae

C. Living organisms occupy a certain niche in their environment.

QUESTIONS

1. What is a niche?
2. Can there be more than one niche in a given habitat?

ACTIVITIES

*1-2 Discuss niche and how it is different from the habitat of an organism. This is best done in an out-of-door setting such as a pond or woodland where you can point out the habitat and discuss how the organisms contribute to the functioning of that habitat.

*1-2 Observe and discuss the habits demonstrated by certain animals in occupying their niche.

Example: Observe a squirrel and its eating habits.

a. They eat twigs and buds of trees thereby helping to prune the trees for better growth.
b. They eat nuts and acorns thereby assisting in seed dispersal and contributing to the organic content of the soil

*1-2 Observe a decaying tree stump.

a. Is there anything living in this stump?
b. What does the stump feel like?
c. What might be causing this stump to decompose?
d. What will eventually happen to the stump?

*1-2 Notice the mounds caused by a mole.

a. What do you notice about the earth around this mound?
b. How might the mole be contributing to the soil?
c. How might the mole be harming the soil?
d. What other animal performs this function?

*1-2 In the field discuss different animals the children may be familiar with. Determine what the jobs of these animals might be and try to observe their activities.

Examples of animals to use:

a. ants
b. snails
c. earthworms
d. maggots

QUESTIONS

3. May there be more than one organism competing for the same niche?
4. What will this competition for a niche eventually lead to?

ACTIVITIES

*3-4 Study an area where honeysuckle has overrun other vegetation. Notice what has happened to the surrounding plants. Discuss the competition involved and the probable results of their competition.

*3-4 Establish a hypothetical situation where the food supply for birds in a given area is depleted. Draw from the class the suggestion as to what this situation might result in and how the birds might adjust to their situation.

INSTRUCTIONAL MATERIALS

Films: (16mm)

"Plant and Animal Communities: The Changing Balance of Nature", Cor., Ind.

II. SOLAR ENERGY RUNS ALL ECOSYSTEMS. MATTER WITHIN ECOSYSTEMS IS CYCLIC, WHILE ENERGY IS DISSIPATED AND MUST BE CONTINUALLY SUPPLIED.

A. The heat and light of the sun are necessary for life on earth.

QUESTIONS

1. What is solar energy?
2. In what forms do we find solar energy?

ACTIVITIES

1-2 Open a class discussion on how the sun helps us. Some of the following questions could be asked:

a. If the sun would disappear how would things around you be different.
b. Would it ever be light outside? Could you see as well?
c. Would it be colder or warmer if the sun were not around?
d. Do you ever use the heat and light of the sun? How?
e. Show and discuss filmstrip "Energy", McGraw-Hill.

QUESTION

3. Are heat and light necessary for life on earth? How do you know?

ACTIVITY

3. Have the class establish a means of demonstrating the effects of heat and light on living organisms, such as:

a. Plant growth. Use geraniums, coleus, or any small growing plant. Establish conditions such as the following:

(1) average room temperature, constant light
(2) average room temperature, good light
(3) average room temperature, shaded light
(4) average room temperature, complete darkness.

Repeat (1) - (4) using higher and lower temperatures. Have the students make up a chart of observations, recording such information as:

(1) date of observation
(2) number of leaves on the plant
(3) height of the plant
(4) number of new shoots
(5) number of new leaves
(6) a photograph taken weekly of the plants

*b. Animal growth. Take a sample of organisms growing in pond.

Set up an experiment similar to 3a. Record the following observations:

(1) date
(2) gross observation of the particular kinds of organisms found in the pond sample.
(3) microscopic examination of the particular kinds of organisms found in the pond sample.

QUESTION

4. How do different organisms respond to heat and light?

ACTIVITY

*4. Take a trip to an arboretum or state park and observe the effects of heat and light variations on living organisms.

a. Have each student adopt a living organism such as a plant found in a field or in a wooded area.

(1) What is the temperature of the area in which you observed your living organism?
(2) What is the intensity of the light in the same area (shaded heavily, shaded lightly, bright area)?
(3) Note the number of times you observe the organism under the same conditions of heat and light.
(4) Note the number of times you observe an organism under different conditions of heat and light.

b. Take a pond sample.

(1) What is the temperature of the water in a sunny area?
(2) What is the temperature of the water in a shaded area?
(3) Do we find the same organisms in both samples?
(4) Separate each sample from the pond and keep one in sun and the other in the shade. What is the water temperature in the two samples after standing for approximately twenty minutes?
(5) Have you observed differences in sample 1 after an hour in different environments?
(6) Have you observed differences in sample 2 after an hour in different environments?

c. Forest observations:

(1) Look at a small tree

a) Is the tree living?
b) What did it develop from?
c) Where did it start to grow?
d) Was there any light in the soil?
e) Was it alive when it was in the soil?
f) Did it have need of light then?
g) How was it able to live without light?

h) What reason would you suggest for the present need?

(2) Observe an area of soil in the woods.

a) What do you see in the soil?
b) Are there any living organisms in the soil? What are they?
c) How do these organisms respond to light?

d. Classroom activity

Observe the respiration rate of a goldfish in changing temperatures. Put a goldfish in a jar or beaker. Gradually lower the temperature by adding ice cubes slowly, cube by cube. Check the temperature as the ice cubes are being added. Record the changes in the respiratory rate of the goldfish every 5 degrees, centigrade.

QUESTION

5. What seasonal changes do you notice in living organisms which are probably related to variations in heat and light?

ACTIVITY

*5. Have each student adopt a living organism such as a plant over the course of the school year and note the changes in that organism on three different field trips: spring, winter, and fall.

FOLLOW UP ACTIVITIES

1. Show and discuss the film "Seasons of the Year", Cornet, D.C.R.I.M.C.
2. Show and discuss the filmstrip "Energy Relationships", McGraw-Hill.
3. Have the students prepare posters or drawings on "Life in the Forest in Different Seasons".

B. The Use of solar energy by green plants is basic to growth and maintenance of life.

QUESTIONS

1. What is energy?
2. Is energy necessary for life?

ACTIVITIES

1-2 Have a student use a magnifying glass to burn a hole in a piece of white paper.

a. Discuss their understanding of the term and if possible arrive at a concensus of opinion.
b. Research for a definition of energy and evaluate their understanding in the light of the findings.
c. Scavenger hunt for pictures, models, samples of energy-stored and in action.
d. Workshop presentation of group findings to entire class.
e. Display center established in room.
f. Science motivation record: energy.

QUESTIONS

3. Where do you get energy to live: to move, to play, to work?
4. Where does the food you eat come from?

ACTIVITIES

3-4 Make a large food chart for a single day's diet - when class has arrived at the importance of food as our energy source. Ask questions tracing food chains of food sources. Use flannel boards technique. Trace to basic green source. Have each member of the class write a story about each food source.

QUESTION

5. Where does the green plant get its energy?

ACTIVITY

5. Is the green plant a food factory?

a. What is done in a factory?
b. What raw materials does this factory need?
c. What are its products?
d. What words would you use to describe the process?

QUESTION

6. How does the green plant use this energy to make the food you eat?

ACTIVITY

6. Is the green plant a food factory?

   a. What is done in a factory?
   b. What raw materials does this factory need?
   c. What are its products?
   d. What words would you use to describe the process?

QUESTION

7. What do you think would happen to life on earth if the sun didn't exist any longer?

ACTIVITY

*7. In a wooded area

   a. Do you see any signs of life here?
   b. Do you notice any green plants?
   c. Why could you call a green plant a producer?
   d. Do you notice any living organism using dead or decaying foods?

   In a pond area: same as above

   In a field area: same as above

*7. Have members of the class select a particular organism for intensive observation and research to prepare an oral report on this organism's place in the food pyramid.

   Points to include:

   1. Name of organism
   2. Food getting adaptations
   3. Type of food consumed
   4. Environment and protective adaptation for it
   5. Size and number of organisms in relation to place in pyramid.

INSTRUCTIONAL MATERIALS

Filmstrip "Energy Relationships", McGraw-Hill
Films: (16mm)

"A Green Plant and Sunlight", E.B.F., D.C.R.I.M.C.
"Green Plants & Their Importance", E.B.F., D.C.R.I.M.C.
"Living Things & Food", E.B.F., D.C.R.I.M.C.

C. The matter cycles are essential to life.

QUESTION

1. Where do we find water?

ACTIVITY

*1. Take a trip out-of doors to a pond area.

*a. Pond area activity.

(1) Where did the water in the pond come from?
(2) Is there water in the air?
(3) How did it get there?
(4) What causes rain?
(5) How does the soil feel near the pond?
(6) Do the plants and animals of the area contain water?
(7) How did the plants and animals receive the water?

b. Classroom activity

(1) Use the findings from the trip to have the class construct a water cycle.
(2) Have the class devise means for determining whether:

Soil contains water
Air contains water
Plants contain water
Animals contain water

QUESTIONS

2. What happens to the air when animals breathe?
3. What happens to the air when plants breathe?

ACTIVITIES

2-3 Discuss the oxygen - carbon dioxide cycle by which the oxygen produced by plants is used by animals and the carbon dioxide produced by animals is used by plants.

QUESTION

4. How is nitrogen used by plants and animals?
5. Could life continue on earth if materials are not reused? How?
6. Is matter reused?

ACTIVITIES

*4-6 Visit a wooded area in an arboretum or state park.

a. Observe a fallen tree

(1) What would you expect to find if you returned in 5 years?
(2) What would the forest look like if trees fell and nothing happened to them?
(3) Would forest life continue? Why or why not?
(4) What will happen to the tree in time?

b. Observe a rotten log

(1) What is happening to the log?
(2) Does this help the forest? If so, how?

c. Observe forest leaves on the floor of the forest.

(1) Do the leaves make any contribution to the life of the forest?
(2) Will the leaves remain unchanged here?
(3) What happens to the leaves?

d. Observe animal remains

(1) What will happen to these?

e. Observe an area of a field

(1) What can we find in the field that will soon be added to the soil?
(2) Observe clover in the field. Take some carefully to observe "nodules", helpers in the cycle.

*4-6. Visit a pond area[a]

a. Dip into the bottom and edge of the pool. What do you find?
b. When animals and plants in the pond die, what happens to their remains?

FOLLOW UP ACTIVITIES

1. Follow up out-of-door activity with discussions of the oxygen-carbon dioxide cycle as well as the nitrogen cycle. Have students provide examples from their outdoor experience.

INSTRUCTIONAL MATERIALS

Films: (16 mm)

"A Green plant and Sunlight", E.B.F., D.C.R.I.M.C.
"Green Plants and Their Importance", E.B.F., D.C.R.I.M.C.
"Living Things and Food", E.B.F., D.C.R.I.M.C.
"Seasons of the Year", Cor., D.C.R.I.M.C.

Filmstrips:

Filmstrip corresponding to film numbers 1,2,3,

*Refer to appendix for description

"Energy Relationships:, McGraw-Hill

Nature Charts:

"Forest Food Chain" Audubon Society.

III. THERE ARE BIOLOGICAL ACTIVITIES THAT ARE CHARACTERISTIC OF LIVING ORGANISMS.

A. All living organisms need nourishment.

QUESTION

1. Why is it necessary to eat?

ACTIVITY

1. Start an open discussion: we eat to live or live to eat?

1. What are our reasons for eating?

QUESTION

2. What would happen to life on earth without green plants?

ACTIVITY

*2. On a field trip to the woods and field look for evidences of animals using green plants or portions thereof for food. (e.g. Birds eating berries, insects eating leaves, sap-sucker holes in trees, rabbits eating portions of branches).
Have students hypothesize what effect would be forthcoming if these plants were eliminated.

QUESTION

3. In what ways does food help the plant or animal?

ACTIVITY

3. Make a large food chart on the importance of food to our daily lives. Make up a chart:

a. listing different types of food (e.g. wheat)
b. foods pictured in natural state
c. foods considered as types: protein, carbohydrates and fats.

Have the class write about a food source such as a farm, fishery, hunting, truck farming and orchards.

QUESTION

4. Where do plants and animals get the food they need in order to continue to live?

ACTIVITY

*4. Visit the out-of-doors and a pond. Look for organisms that eat smaller organisms as a part of a food chain. Based on observations in the outdoors, make up a food chain showing what birds eat, rabbits eat, bees eat, squirrels eat, other insects, frogs, etc.

*4. Look for some fungi such as a mold growing on a stump and determine where they get their food. Asking questions such as the following:

a. What is living on the stump?
b. What color is this material?
c. Does it produce its own food? What is the reason for your answer?
d. Where might it get its food?

INSTRUCTIONAL MATERIALS

Films: (16 mm)

"Animals and Their Foods", Cor., Syr., Ind.
"Living Things and Food", E.B.F., D.C.R.I.M.C.

Nature Charts:

"Forest Food Chains", National Audubon Society

B. Living Organisms must reproduce in order to continue the species.

QUESTIONS

1. How many of you know of an animal that has had babies?
2. What have you noticed about these babies?

ACTIVITIES

*1-2. On a trip to the out-of-doors (woods, field, and/or pond) have students look for examples of the adult and young of animals and compare the two (frog-tadpole-egg-insect as adult - insect in pupal, cocoon or egg stage, adult grasshopper - numph grasshopper, adult birds - young birds, adult mammals - young mammals).

*1-2. Have students look for birds nests. How do birds use nests? Have you ever noticed birds taking food to the nest? Have you noticed a young bird out of the nest that can't fly?

QUESTIONS

3. How many of you have seen a young tree?
4. What have you noticed about this young tree?

ACTIVITIES

*3-4. Go to an area where there are young trees growing. What does a young tree look like? Does it look like any other tree in this area? How do you believe this particular tree got to grow there? What seed dispersal method do you think was used?

QUESTION

5. What do you notice about the young of all living organisms?

ACTIVITY

*5. After having compared young organisms to adult organisms on a field trip discuss with the students the question "How do you know that a plant or animal is young?"

QUESTION

6. How do plants reproduce?

ACTIVITY

*6. Abundance of nature. Count the number of seeds found under a tree. How many (pointing out) will become big trees?

Why won't all of them become trees?

Dispersal of seeds:

How are seeds dispersed by man?
How are seeds dispersed by animal?
How are seeds dispersed by winds?
How are seeds dispersed by water?
Have you seen any of the above dispersal of seeds?
Give examples.
How are milk seeds dispersed?
How is gravity used in the dispersal of seeds?

QUESTION

7. How do animals reproduce?

ACTIVITY

7. Reproductive processes may be readily observed if white mice or rats, or other small mammals are maintained in the classroom. On a field trip you may use example of insects mating, if found.

QUESTION

8. How does every living organism begin its life?

ACTIVITY

*8. On a field trip to woods, field, pond have children study the reproductive habits and characteristics of several insects and plants. (Can they find eggs, seeds, life stages, etc.)

*8. Discuss the reproductive processes with which the pupils may be familiar. Visit an out-of-door area which possesses vivid sensory imagery such as woods, ponds, and grassland to show the results of reproduction.

INSTRUCTIONAL MATERIALS

Films:

"Life Goes On and On", E.B.F., D.C.R.I.M.C.

Filmstrips:

Filmstrip corresponding to film # 1 "Plants: How they Live and Grow", E.B.F.

Nature Charts:

"Common Seed Travelers", National Audubon Society

C. All living organisms react to their surroundings.

QUESTION

1. What are several environmental conditions that have a direct influence on living organisms?

ACTIVITY

*1. Students should compare and contrast a woods, a field, and/or a pond at two different seasons for the animal and plant life present. Students should hypothesize what environmental conditions made the differences come about. (Discuss length of day, temperature, amount of rain, etc.)

QUESTION

2. How does light influence plants and animals?

ACTIVITY

2. Classroom Activity. Grow two plants: one under normal light conditions and one in a dark closet to show the influence of light on plants.

*2. Outdoor Activity.

a. Go to a forest area and look for examples of how trees respond to sunlight and indirect sunlight. Find some underdeveloped trees. Give some reasons why they are underdeveloped. Give reasons for other trees being tall and straight.

b. Have students examine a rotting log, under leaf litter, and/or under rocks to determine whether there are some animals that avoid bright light (salamanders, earthworms, insects (beetles), sow bugs).

QUESTION

3. How does temperature influence plants and animals?

ACTIVITY

3. Classroom Activity

a. Grow two plants: One at classroom temperature and one at considerably lower temperatures (using a refrigerator).

b. Have students see the effect of different water temperatures on the respiratory rate of goldfish. Place one goldfish in water which is at room temperature, one in cooler water, and

one in warmer water. Have students count the number of times the fish opens and closes its gills and see whether the rate per minute is the same for all three water temperatures.

*3. Outdoor Activity. Look for changes in leaves as the fall season progresses. What is the effect of temperature on leaf loss?

QUESTION

4. How does water influence plants and animals?

ACTIVITY

4. Classroom Activity. Grow two plants: water one normally, do not water the other. Record the results.

*4. Outdoor Activity

a. Visit a pond[a]

(1) What kind of animals would you expect to find in the pond?
(2) What kind of animals do you find in the pond? Describe them.
(3) What would happen to these animals if there was no water?

QUESTION

5. How does a source of food influence plants and animals?

ACTIVITY

*5. Have the students conduct an investigation of a pond environment. Have students collect plant and animal specimens hypothesizing on which organisms are eaten by others. Finally, have students hypothesize what would occur if one of these organisms was exterminated from the environment. What effect would this incident have on nature?

INSTRUCTIONAL MATERIALS

Films: (16 mm)

"Animals and Their Foods", Cor., Syr., Ind.
"Life Goes On and On", E.B.F., D.C.R.I.M.C.
"Living Things and Food", E.B.F., D.C.R.I.M.C.

Filmstrips:

"Plants: How they Live and Grow", E.B.F.

Nature Charts:

"Common Seed Travelers", National Audubon Society

[a]Refer to appendix for description.

IV. LIFE CANNOT BE STATIC IT MUST ADAPT AND EVOLVE OR PERISH.

A. The life cycle of an organism is adapted to its special environment or habitat.

QUESTIONS

1. What is meant by a life cycle?
2. What organisms with which you are familiar will go through life cycles?

ACTIVITIES

*1-2. On a trip to the woods and field have students locate egg larval, pupal, and adult stages of animals (preying mantis cocoon, tent caterpillars, butterfly, and moth cocoons, etc.) Hypothesize what each stage looked like previously and what it will look like in the future.

*1-2. Conduct a pond investigation[a] and have students collect different life stages of animals (snails, dragonflies, mayflies, diving beetles, caddis fly, frog)

QUESTIONS

3. How could an organism's life cycle contribute to its survival in its environment?
4. In different stages of an organism's life cycle, does its habitat or environment change? If so, in what way?

ACTIVITIES

*3-4. Collect some frog eggs. Keep them in the classroom in an aquarium. As the frog develops from its egg, note the different stages of the life cycle, the changes in the frog's physical appearance, and the change in the frog's activities. (Be sure to provide an area in the aquarium on which the adult frog may rest when it emerges).

*3-4. Visit a pond.

a. What sounds do you hear coming from the pond?
b. Can you hear or see any frogs in the pond?
c. Where in the pond do you find the frogs living?
d. Are there any other animals in the pond that resemble frogs?
e. From what do frogs develop?
f. Where do tadpoles live in the pond?
g. How are tadpoles adapted to live in their environments?
h. How are frogs adapted to live in their environment?

3-4 Discuss the activities of butterflies. This discussion would best be initiated if the children could see butterflies.

[a]Refer to appendix for description.

Locate some caterpillar cocoons. Culture them in the classroom in a large jar such as a battery jar and watch them emerge.

a. How do butterflies get from one flower to another?
b. Have butterflies always been able to fly?
c. Have butterflies always taken the form with which we are familiar?
d. Where do butterflies come from?
e. Does a caterpillar use the same means of locomotion as does the butterfly?
f. How does the butterfly change its immediate environment as it proceeds through its life cycle?
g. Might the butterfly's niche change as it proceeds through its life cycle?

B. When an organism's environment changes, it must adjust or perish.

QUESTIONS

1. What do all living organisms need in order to survive?
2. Where do living organisms get the things they need in order to survive?

ACTIVITIES

1-2 Classroom activity.

a. Lead the class into a discussion of their basic needs as individuals and then compare these with the needs of other living organisms.
b. Have the class form into committees, each committee responsible for a bean plant. Have each committee deprive their plant of a different need such as water, sunlight, soil and air. Also, allow a plant to be over-watered and another to be placed in the direct sunlight. Have one committee give their plant normal care. Have each committee report on their observations as compared to a plant that has received normal care.

*1-2. On a field trip to woods, field, and/or pond have students determine whether the organisms they find all have access to the basic needs identified in the early part of this activity.

QUESTION

3. If a living organism's environment changes, will its needs change?

ACTIVITY

*3. On a field trip observe the same species of tree growing in different locales - such as in the middle of the forest and in a field.

(1) Do these trees both need water and sunlight?
(2) Do these trees need soil to grow in?
(3) Do all trees have certain basic needs no matter where they are living?

QUESTION

4. What does a living organism do to meet changes in its environment?

ACTIVITY

*4. On a field trip observe the trees in the under story of the forest:

(1) Do the trees grow in a straight-up direction? Why or why not?
(2) Do all the branches grow straight out from the tree trunks? Why or why not?
(3) What might cause the irregular shapes of some of the trees?

*4. On a field trip observe and discuss habits of squirrels.

(1) What do squirrels eat?
(2) Do they immediately eat all the food they collect?
(3) What do they do with the food they don't eat?
(4) When might they eat this food?

*4. On a field trip observe and discuss birds.

(1) Do you hear much bird activity in a woods all of the time?
(2) Where do some of the birds go during the winter months?
(3) What might be some of the reasons for the birds leaving in the winter?

QUESTION

5. If a living organism cannot adjust to its environment, what will happen to it?

ACTIVITY

*5. On a field trip observe two trees of the same species: one growing and one dead - located close to one another.

(1) What is the difference between these two trees?
(2) Do you notice anything growing around one tree that is not growing around the other?
(3) Is it possible that competition might have killed the dead trees?
(4) What wasn't the dead tree able to do in order to survive?

C. The more specialized the organism, the greater the difficulty it will have in adjusting to a change in environment.

QUESTIONS

1. What does specialization in plants and animals mean?
2. What are some examples of specialization in plants and animals?

ACTIVITIES

*1-2. In an out-of-door setting, observe and discuss how certain organisms are specialized to live in certain environments.

a. Pond.

(1) What animals live in ponds?
(2) How are these animals equipped to live in this environment?
(3) Do you think these animals could successfully live in an evnironment other than a pond? Explain why or why not?

b. Forest.

(1) What animals live in the forest?
(2) How are these animals equipped to live in this environment?
(3) Do you think some of these animals could successfully live in an environment other than the forest? Explain why or why not.

QUESTIONS

3. How does specialization assist the organism in its life activities?
4. How does specialization contribute to an organism's success in its environment?

ACTIVITIES

*3-4. Study the green frog that lives in the pond.

a. How does the frog move about the pond?
b. What color is the frog and how may his coloring be an asset to his living in this environment?
c. What food does the frog eat and how does he catch his food?
d. If the green frog were removed from his natrual habitat - the pond - what might happen to him?

This activity may be used to discuss specialization in other organisms such as birds, earthworms, cacti.

*3-4. Observe the activities of birds.

a. Where in a forest do you find birds?
b. What do birds eat?
c. How are birds specialized for locomotion and food getting?

*3-4. Have the students, on their field-trip, compile a chart showing specialization in animals. (See example below).

EXAMPLE

ANIMAL	LOCOMOTION	FOOD GETTING	COLORING
Frog	Webbed feet hopping	Long tongue	Green spotted

*3-4. Note the plants that have specialized parts for seed dispersal. Discuss this specialization and show class how certain seeds are easily picked up by passing animals; other seeds are easily carried by the wind. Have students look for seeds that have stuck to their clothing.

QUESTION

5. If there should be a change in the specialized organism's environment, what affect might this change have on that organism?

ACTIVITY

*5. Involve the students in a discussion while at the pond or in the forest bringing out how these specialized plants and animals would be affected by a change in their immediate environments.

a. If the pond were suddenly polluted and the frogs could no longer find food, what might happen to the frogs if they had to inhabit the forest?
b. If a forest were competely destroyed by a forest fire, what might happen to the birds and insects that inhabited this forest?

INSTRUCTIONAL MATERIALS

Films: (16 mm)

"Adaptations of plants and Animals", Cor., Syr., Ind.
"How Nature Protects Animals", E.B.F., D.C.R.I.M.C., S.S.A.V.L. Syr., Ind.

V. BIOLOGICAL AND PHYSICAL FACTORS WILL DEFINE THE LIMITATIONS OF ORGANISMS.

A. Physical conditions determine growth.

QUESTIONS

1. What is meant by physical factors?
2. What physical factors could limit growth?
3. How could these physical factors limit growth?

ACTIVITIES

1-3. Hold a lighted match near a leaf of a green plant.

a. What happens to the leaf?
b. Does the leaf change color?
c. Does the leaf move when the match is brought close?
d. What might have caused a change in this leaf?
e. What do you think will eventually happen to this leaf if the match remains close?
f. If a whole plant were subjected to excessive hear, what will happen to it?

1-3. Deprive a plant of water for several days.

a. What does this plant look like?
b. What does this plant feel like?
c. Compare this plant with a healthy plant.
d. What might eventually happen to this plant?

The above activity could also be done with any plant that you treat in other than normal manner, e.g. overwatering, allowing to grow in closet, placing in direct sunlight, etc.

QUESTIONS

4. What effects do these physical factors have on plant growth?
5. What effects do these physical factors have on animal growth?

ACTIVITIES

*4-5. Visit an arboretum or state park:

a. Point out a tree that had died because of competition from surrounding trees.

(1) What do you notice growing around this dead tree?
(2) What might have caused this tree to die?
(3) What do you think will eventually happen to this tree?
(4) What could you do to find out if your guess (answer to question 4) is a good one.

b. Observe two trees of the same species and near to the same age growing in the same area.

(1) Do both of these trees look the same? Do they look different? In what ways?
(2) What may have caused these trees to grow differently?
(3) What physical factors might have caused the differences in the growth of these trees?

*4-5. Visit an area where erosion is evident.

a. How does the area differ from a forest or field?
b. What does the soil feel like?
c. Are there many rocks and stones in the soil?
d. Are there many plants growing in this area?
e. What physical factors might have caused this area to appear this way?

INSTRUCTIONAL MATERIALS

Films:

"Plant and Animal Communities: Physical Environment", Cor., Ind.

B. Biological factors will define the limitations of organisms.

QUESTIONS

1. What do we mean by "biological factors"?
2. What do we mean by the word "limitation"?

ACTIVITIES

1-2. Discuss with the class the meaning of the term "biological factors" and the term "limitation".

1-2. List the results of class discussion to see if there are sufficient findings to apply to observations to be made on a field trip to the arboretum.

QUESTION

3. How does food supply determine the limitations of organisms?

ACTIVITY

*3. On a field trip have the students observe or hypothesize what types of food certain organisms eat. Students should then attempt to explain what the effects would be if there was more or less of these types of food.

QUESTION

4. How do predators affect the limitations of organisms?

ACTIVITY

*4. Visit a pond. Take samples of living organisms from various areas around the pond's edge[a].

a. What do we mean by the word "predator"? By the word "prey"?
b. What do we mean by the word "carnivore"? By the word "herbivore"?
c. Try to figure out from the collected samples of living organisms which are the predators. Which are the prey? Which are herbivores? Which are the carivores? (Note: this is not intended to get too involved at this grade level. The students should know, for instance, that frogs eat insects, etc. and some insects feed on plants. The pointing out of various adaptations regarding mouth parts should help the children to understand the concept).
d. What would happen if there were no predators in the pond?
e. What would happen if the numbers of a particular organism became greatly reduced? Greatly increased?

[a]Refer to appendix for description.

f. Explain why an ecologist says that there is no such thing as a "good guy" or a "bad guy" when referring to populations such as you would find in a pond.

QUESTION

5. Can you think of any other biological factors which may limit organisms? Name them.

ACTIVITIES

*5. Examine a patch of honeysuckle.

a. What do you notice about this plant?
b. Look at the vegetation surrounding the individual honeysuckle plant. What effect does the honeysuckle seem to have on the vegetation?
c. Is the presence of honeysuckle advantageous or disadvantageous to the other plants? Give your reasons.

*5. Examine an elm tree which has become infected with the Dutch Elm disease.

a. What do you notice about this tree?
b. How does it differ from other trees around it?
c. What do you think may cause the tree to look like this?
d. What do you think will eventually happen to the other trees?

*5. Begin a discussion of other biological factors which may limit organisms, as for example?

a. Ecological succession - the growth of different types of plants may change the food source of some organisms (young trees shading out perennial herbs) in which case the organisms would have to adjust, move or die. Visit a field to observe ecological succession.

b. Animals assist in the dispersal of seeds. e.g. Burr-dock and enchanters night shade.

INSTRUCTIONAL MATERIALS

Films: (16 mm)

"Animals and Their Food", Cor., Ind.
"Living Things and Their Food", E.B.F., D.C.R.I.M.C.

C. Some plant and animal populations in a given area may change with time.

QUESTIONS

1. How would your neighborhood look if you could see it as it was a hundred years ago?
2. What changes have taken place in your neighborhood?

ACTIVITIES

1-2. General discussion of changes in student's neighborhood. Possibly obtain pictures and reports from library, historical society or chamber of commerce showing the changes in the neighborhood.

QUESTION

3. Has the natural world always been the same?

ACTIVITY

3. Have students hypothesize whether the natural world has always been the same and give reasons for their hypothesis. Have students design an investigation "How would you find out?"

QUESTIONS

4. What changes take place in the natural world?
5. What might have caused these changes?

ACTIVITIES

*4-5. Visit a pond. The pond should be visited at various seasons and the relative abundance of the various organisms observed.

a. What does the pond look like? What kind of organisms do we find in the pond?
b. What is floating on the pond? Which organisms are the most abundant?

4-5. Set up one or two aquaria in the room. Allow them to remain for several weeks without cleaning them. Observe the successive changes in these aquaria.

4-5. Initiate a general discussion on things familiar to the students near their homes.

a. What would happen if you didn't cut and weed your lawn? What do the vacant lots in your neighborhood look like when they haven't been cared for?

QUESTION

6. Will the natural world to on changing? What changes can we expect?

ACTIVITIES

*6. Initiate discussion of beach succession.

a. What does the beach look like?
b. Do any plants grow on the beach?
c. Where do these plants grow?
d. Are the plants which grow farther from the water larger or smaller than those which grow close to the water?

*6. Visit a field showing stages in succession.

a. What do you notice about this field?
b. Is the vegetation the same all over this field?
c. Do you see shrubs in this field?
d. How does any of the vegetation in this field resemble or differ from that of the forest?
e. Where might the young trees in the field have come from? Look for the parent trees.
f. What might this field look like in twenty years?
g. As the field's plant population changes, will its animal population change? Why or why not?

INSTRUCTIONAL MATERIALS

Films: (16 mm)

"Why Plants Grow Where They Do", Cor.

VI. THE ENORMOUS POWER OF MEN TO AFFECT WHOLE ECOSYSTEMS IS OF GREAT IMPORTANCE TO THE FUTURE OF THE BIOSPHERE.

A. Man affects the reservoir of air, water and food essential to members of the ecosystem.

QUESTION

1. What is the "balance" of nature?

ACTIVITY

1. Open a class discussion of what is meant by the term "balance" and how it could be applied to the natural world. (Animal and plant needs vs. availability of needs).

QUESTION

2. What are the basic needs of plants and animals?

ACTIVITY

2. In order to predispose students for their field experience, the following discussion of man's needs should be initiated. Here are some suggested questions directed toward understanding the necessity of air, water and food for man:

   (1) What happens to people in a burning house who can't escape?
   (2) What would happen to the astronauts if they went into outer space without space suits and other equipment?
   (3) What happens when cooking gas escapes and fills a room in which someone is sleeping?
   (4) What happens to mountain climbers at very high altitudes?
   (5) What happens to people who drown in the ocean?
   (6) What happens to sailors who are adrift in the ocean?
   (7) What happens to people who go to the desert without a supply of water?
   (8) What might happen to those who do not eat the right kind of food?

   Go to a wooded area, field, or pond.

   (1) Have the class decide upon an organism which will be observed for discussion.
   (2) What are its needs? (Compare to man's needs).
   (3) Where does it obtain its needs?
   (4) What changes could we make in this environment that would deprive the organism of one of these needs?
   (5) Use flannel board to picture the organism and its needs.
   (6) What would happen to the organism if it were deprived of these needs?

Use this format for as many organisms as desired. Suggested organisms: toad, bee, squirrel, backswimmer, algae, cat bird, tulip tree, mushrooms, phlox, clover, grasshopper, snake, rabbit, field mouse.

QUESTIONS

3. How does man alter the air essential to plants and animals?
4. How does man alter the water essential to plants and animals?
5. How does man alter the food essential to plants and animals?

ACTIVITIES

3-5. Divide class into three groups for research.

a. Group 1 "Alterations made by man in the air available to the plants and animals". Suggested topics:

(1) Industrial air pollution
(2) Radioactive fallout
(3) D.D.T. and other insect sprays
(4) Automobile exhaust pollution

b. Group 2 "Alterations made by man in the water available to plants and animals". Suggested topics:

(1) Industrial contamination
(2) Forestation
(3) Spraying with pesticides
(4) Community construction
(5) Farming and soil erosion

c. Group 3 "Alterations made by man in the food available to plants and animals". Suggested topics:

(1) DDT and other insect sprays
(2) Mercury poisoning

QUESTION

6. How does man disrupt the balance of nature by altering those things necessary to living organisms?

ACTIVITY

6. Have the class discuss the balance of nature in light of the findings made in activities 3-5.

QUESTION

7. In what ways can man improve his use of resources?

ACTIVITY

*7. Have the students hypothesize how man can improve his use of

resources (can launch into a discussion about conservation practices). Students should then implement, on a class basis, a practice which they feel would help to keep nature in balance.

FOLLOW UP ACTIVITIES

1. Students can construct a diorama showing practices of both conservation and pollution for a particular topic. On a field trip look for examples of the above.

2. Invite a specialist who could speak to the class on "Practices of Community Conservation and Pollution". (Usually these are specialists available at the local county or parish level).

B. Man affects the habitats of organisms.

QUESTION

1. What are natural resources?

ACTIVITY

1. Have students make lists of natural resources.

QUESTION

2. How has man used these natural resources?

ACTIVITY

2. Make a bulletin board display of natural resources and their uses.

QUESTIONS

3. In what way is man dependent upon these natural resources?
4. What relationship exists between our natural resources and the habitats of organisms?
5. What can you do to improve the use of our natural resources?

ACTIVITIES

*3-5. Take students on a field trip to an arboretum or state park. Have them look for examples of natural resources in various habitats, i.e., field forest and pond. Look for examples of man's influences on these habitats and resources, i.e., construction, agriculture, erosion, recreation, etc.

QUESTION

6. What can you do to improve the use of our natural resources?

ACTIVITIES

*6. Students should hypothesize on a field trip how man's destructive impact on his environment could be lessened.

INSTRUCTIONAL MATERIALS

Films: (16mm)

"Forests and Conservation", Cor., Syr.
"Meaning of Conservation", D.C.R.I.M.C.
"The Story of Soil", Cor., Ind.
"Trees and Their Importance", E.B.F.
"Use of Forest", Cor., Syr., Ind.

C. An appreciation of the beauty contained in our environment is necessary for our present and future well-being.

QUESTIONS

1. How can we discover and enjoy the beauty which nature contains?
2. In what ways are nature hobbies and special interests important to our well-being?
3. In what ways is an appreciation of the beauty contained in our environment necessary for our present well-being?
4. In what ways is an appreciation of beauty contained in our environment necessary for our future well-being?

ACTIVITIES

1-4. Open a class discussion regarding students' present ideas concerning the concept.

QUESTIONS

5. How can we help others share in this discovery and enjoyment?
6. Where can beauty be found in our natural surroundings?

ACTIVITIES

5-6. Have each student undertake a project in some area consonant with his interest or possible interest. It may be necessary for the teacher to out-line areas of investigations not suggested here. Excellent sources for ideas are:

Goldsmith, M. Picture Primer of Indoor Gardening, Boston: Houghton, Mifflin Co.,1946.

Saunders, J.R. The Golden Book of Nature Crafts, New York; Golden Press, 1958.

700 Experiments for Everyone compiled by UNESCO, New York: Doubleday and Co., Inc., 1958.

*a. Make a wood collection by obtaining fallen branches of as many different species of trees as you can find. Label and identify a section of the branches for display. Prepare a list of uses commonly made of the various species. (Saunders ibid, p. 43)

*b. Collect fallen leaves from a particular area in the fall and spring. Identify and preserve the collected leaves. Prepare leaf prints and leaf skeletons. (Saunders ibid, pages 28 and 56.)

*c. Have the children locate as many different kinds of seeds

and nuts as they can find in a particular area. Have them record and prepare a chart showing the location where the seed or nut was found, the time located, and which tree produced them. (Saunders, ibid, p. 52)

*d. Collect feathers within a given area. Have the students make a chart listing where the feather was found, when found, and the bird from which it came (determine the sex of bird, if possible). Add to the chart pictures of photographs of the birds.

*e. Have the students set up a bird feeding station where they can observe birds and learn to identify them. Have them tape the sounds of the birds and learn to identify birds on the basis of bird calls.

*f. Have the children look for bird's nests and other examples of animal homes. (Be sure to instruct them not to distrub them). Have them keep a record of the location, a description of the home, and whether or not they have observed any animal entering or leaving it. Have them observe and identify animal tracks. They should make a sketch of the animal homes which they have observed. (Cf. Saunders, ibid, p. 30)

*g. Have the students make a soil collection by collecting quantities of soil from different sections of a particular area in baby food jars or small vials. Have them describe the physical characteristics of the soil, try to identify it, preserve and label for display purposes.

APPENDIX A

DESCRIPTIONS AND EXPLANATIONS OF PRIMARY PROCEDURES AND MATERIALS

I. INVESTIGATION OF THE POND ENVIRONMENT.

Exploration of the pond environment can be benefited by using the following materials and equipment:

a. A white enamel pan (or suitable substiute).
b. A dip net or large food strainer.
c. An extension for the dip net or strainer using a light weight pole.
d. Individual collection jars with a small amount of pond water (baby food jars with screw caps).
e. Hand lens.
f. Microscope.
g. Identification keys.

The following procedures can be followed:

a. Each child can directly collect specimens from the pond by using dip nets or strainers. If the dip nets are fastendd to light weight poles, the specimens can be gathered at a greater distance from the pool side.
b. As the specimens are collected, they can be placed in the jars that each individual should have.
c. When the small jars have a reasonable number of specimens in them they may be emptied into the white enamel pans for identification. Identification keys are useful for this.
d. Specimens may be examined more closely by using the hand lens or microscope.
e. Specimens should be returned to the pond after being examined.

II. TRIP JOURNAL

An individual notebook (commercial or handmade) to be kept exclusively for recording nature trip experiences.

III. "SOFT-SHOE" WALK

A "soft-shoe" walk is a good method for experiencing the sounds of the forest. The students should be signaled at various times that "soft-shoe" conditions are in effect. At this time no sounds or talking shall be made. The walk can continue with appropriate stops signaled by the teacher or leader when distinct natural sounds are heard.

IV. ROPE RING

The forest floor can become an interesting area for investigation by the individual. To give each student a specific area for investigation, a rope ring can be made from a 36 inch piece of rope or string. The rope should be tied to form a ring. After the

student places the ring on the forest floor (heavily leafed area is best), he can examine the materials and animal life contained in the ring. A white piece of paper makes a good examination table upon which the specimens can be placed.

V. TRAIL BAG

Each student can carry a trail bag or kit during his nature rambles. The kit can be as simple as a brown paper bag or can be as sophisticated as a carefully designed canvas or cloth shoulder bag.

The following materials are suggested as contents for the kits:

a. Magnifying glass.
b. Small glass or plastic vial with lid containing alcohol for insect collection.
c. Notebook and pencil.
d. 36 inch of rope or string (see rope ring activity).
e. Clay.
f. First aid materials and insect repellent.
g. Identification keys.

KEY TO INSTRUCTIONAL MATERIAL

All films listed may be ordered from any film source available to the school.

The filmstrips listed are available from commercial sources.

KEY:

C.M.	Curriculum Materials Inc. 1319 Vine Street Philadelphia, Pennsylvania
D.C.R.I.M.C.	Delaware-Chester County Regional Instructional Materials Center 14 Anderson Hall State College West Chester, Pennsylvania (Formerly, Del-Ches Film Library)
D.P.I.	Department of Public Instruction Harrisburg, Pennsylvania
E.	Eyegate
E.B.F.	Encyclopedia Britannica Films 1150 Wilmette Avenue Wilmette, Illinois 60091
Ind.	Indiana University Film Library Bloomington, Indiana
N.F.B.C.	National Film Board of Canada 1270 Avenue of Americas New York, New York
Penn S.	Pennsylvania State University Film Library University Park, Pennsylvania
S.P.	Stanbow Productions 12 Cleveland Street Valhalla, New York
S.S.A.V.L.	Southeast Suburban Audio-Visual Library S. Wayne Avenue Wayne, Pennsylvania
S.V.E.	Society of Visual Education 1345 Diversey Parkway Chicago, Illinois 60614
Syr.	Syracuse University Film Library Syracuse, New York 13219

ELEMENTARY SCIENCE SERIES

BIBLIOGRAPHY

1. Beauchamp, Wilbur I., Crampton, Gertrude, and Gray, William S. How Do We Know? New York, Scott Foresman & Co., 1945.

2. Bond, Austin D., Bond, Guy L. Clymer, Theodore and Bell, Kate. Thinking About Science. Wilkes Barre, Pennsylvania, Lyons & Carnahan, 1958.

3. Brandewein, Paul F., Cooper, Elizabeth K., Blackwood, Paul Ed., and Hone, Elizabeth B., Concepts In Science. New York, Harcourt, Brace & World, Inc., 1966.

4. Craig, Gerald S. and Bryan, Bernice C. Science Near You. New York, Ginn & Co., 1954.

5. Craig, Gerald S. and Daniel, Etheleen. Science Around You. New York, Ginn & Co., 1958.

6. Craig, Gerald S. and Lembach, Marguerite W. Science Everywhere. New York, Ginn & Co., 1958.

7. Craig, Gerald S. and Hurley, Beatrice Davis. Discovering With Science. New York, Ginn & Co., 1958.

8. Craig, Gerald S. and Hill, Katherine E. Adventuring In Science. New York, Ginn & Co., 1958.

9. Craig, Gerald S., Roche, Ruth Lippenberger, and Navarra, John Gabriel, Experimenting in Science. New York, Ginn & Co., 1958.

10. Navarra, John Gabriel and Zafforoni, Joseph. Today's Basic Science and Now You Do It. Evanston, Illinois, Harper & Row, 1963.

11. Navarra, John Gabriel and Zafforoni, Joseph. Today's Basic Science. Evanston, Illinois, Harper & Row, 1963.

12. Schneider, Herman and Nina. Science for Work and Play. Boston, D.C. Heath & Co., 1965.

13. Schneider, Herman & Nina. Science For Here and Now. Boston, D.C. Heath & Co., 1961.

14. Schneider, Herman & Nina. Science Far and Near. Boston, D.C. Heath & Co., 1961.

15. Schneider, Herman & Nina. Science In Your Life. Boston, D.C. Heath and Co., 1961.

16. Schneider, Herman and Nina. Science for Today and Tomorrow. Boston, D.C. Heath & Co., 1961.

17. Schneider, Herman & Nina. Science In Our World. Boston, D.C. Heath and Co., 1961.

18. Smith, Herbert A., Blecha, Milo K., and Sternig, John. Science 1 - 6. River Forest, Illinois, Laidlaw Brothers, 1966.

19. Stone, George K., and Stephenson, Lucy W. Science You Can Use. Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1959.

20. Thorn, Sam and Harbeck, Irene. Let's Find Out. Chicago, Beckley-Cardy Co., 1951.

21. Thorn, Sam and Harbeck, Irene. Let's Look Around. Chicago, Beckley-Cardy Co., 1952.

22. Thorn, Sam and Harbeck, Irene. Let's See Why. Chicago, Beckley-Cardy Co., 1952.

23. Thurber, Walter, A. and Durkee, Mary C. Exploring Science. Boston, Allyn & Bacon Inc., 1966.

24. Thurber, Walter A. and Kilburn, Robert Ed. Exploring Science. Boston, Allyn & Bacon Inc., 1965.

25. Thurber, Walter A. and Kilburn, Robert Ed. Exploring Science. Boston, Allyn & Bacon, Inc., 1966.

ELEMENTARY SCIENCE

BIBLIOGRAPHY

1. Bulla, Clyde Robert. A Tree is a Plant. New York, Thomas Y. Crowell Co., 1960.

2. Bronson, Wilfred S. The Wonder World of Ants. New York, Harcourt, Brace and World, 1937.

3. Hutchins, Ross Ed. Insects - Hunters and Trappers. New York, Rand McNally and Co., 1958.

4. Hirsch, S. Carl. The Living Community - A Venture Into Ecology. New York, The Viking Press. 1966.

5. Huntington, Harriet E. Let's Go Outdoors. New York, Doubleday and Co., 1939.

6. Lane, Ferdinand C. All About the Flowering World. New York, Random House, 1956.

7. Lemmon, Robert S. All About Birds. New York, Random House, 1955.

TEXTS

1. Dowling, T.I., K. Freeman, N. Lacy, and J.S. Tippett. Seeing Why. Philadelphia, John C. Winston Co., 1951.

2. Dowling T.I., K. Freeman, N. Lacy, and J.S. Tippett. I Wonder Why. Philadelphia, John C. Winston Co., 1951.

3. Thorn, S., and I. Barbeck. Let's Find Out. Chicago, Beckley-Cardy Co., 1951.

4. Thorn, S., and I. Barbeck. Let's Look Around. Chicago, Beckley-Cardy Co., 1952.

FIELD GUIDES

BIBLIOGRAPHY

1. Comstock, A.B. Handbook of Nature Study. New York City, Comstock Publishing Co., 1963.

2. Dana, W.S. How to Know the Wildflowers. New York, Dover Publications, Inc., 1963.

3. Hilcourt, W. Nature Activities and Conservation. New York, Putnam's Sons, 1961.

4. Mathews, F.S. American Trees and Shrubs. New York, Putnam's Sons, 1915.

5. Morgan, A.H. Field Book of Ponds and Streams. New York, B.P. Putnam's Sons, 1930

6. Needham, J.G. and P.R. Needham. A Guide to the Study of Fresh Water Biology. San Francisco, Holden-Day, Inc., 1962.

7. Peterson, R.T. A Field Guide to the Birds. Boston, Houghton Mifflin Co., 1947.

8. Petrides, G.A. A Field Guide to Trees and Shrubs. Boston, Houghton Mifflin Co., 1958.

9. Pough, R.H. Audubon Land Bird Guide. Garden City, Doubleday & Co., 1949.

10. Pough, R.H. Audubon Water Bird Guide. Garden City, Doubleday & Co., 1949.

11. Swain, R.B. The Insect Guide. Garden City, Doubleday & Co., Inc. 1948.

12. Van DerSmissen, B. and O.H. Goering, A Leader's Guide to Nature-Oriented Activities. New York, Iowa State University Press, 1961.

13. U.S. Department of Agriculture. Soil Survey. Chester and Delaware Counties, Penna. 1959.

EVALUATION

Evaluation should consist of the use of many techniques and should always measure in terms of the performance objectives.

1. Teacher-made test
2. Standardized test
3. Evaluation by discussion, demonstration, experimentation, and observttion.
4. Pre-test
5. Experiences
6. Post-test

Materials

1. Materials for the Classroom
   a. Films (See list in Curriculum Guide)
   b. Pictures
   c. Magazines, Newspapers
   d. Reference books
   e. Exhibits, objects, specimens, models, mountings, dioramas.
   f. Schoolroom plants, animals
   g. Maps, globes
   h. Charts, posters, graphs
2. Materials from the Community
   a. Homes
   b. Public museum
   c. Local stores and industries
   d. Chamber of Commerce
   e. Corporations
   f. Local Environment Agencies(see other list in Curriculum package)
   g. Ponds, streams, other resource areas in the community